amendment in accordance with 37 C.F.R. § 1.121(c)(1)(ii). Any paragraph not accompanied by a marked up version has not been changed relative to the immediate prior version.

Replace the paragraph beginning on page 7, line 21 through page 8, line 1 with the following:

To determine the calibration constants, the algorithm first searches the spectrum for peaks significantly above the background. The centroids of these peaks are matched to a specified pattern to identify the individual peaks. Then, a non-linear least square fit of experimental peak energies versus expected peak energies is performed to determine the three constants.

In the Claims:

Please replace the claims with the following clean version of the entire set of pending claims, in accordance with 37 C.F.R. § 1.121(c)(1)(i). Cancel all previous versions of any pending claim.

A marked up version showing amendments to any claims being changed is provided in one or more accompanying pages separate from this amendment in accordance with 37 C.F.R. § 1.121(c)(1)(ii). Any claim not accompanied by a marked up version has not been changed relative to the immediate prior version, except that marked up versions are not being supplied for any added of canceled claim.

CLAIMS

1. (Twice Amended) A method for identifying a chemical substance, the method comprising:

exposing said chemical substance to neutrons from an isotopic neutron source;

measuring, with a high purity germanium detector, gamma rays emitted by said chemical

substance as a result of exposure to said neutrons;

creating a single spectrum of between 4096 and 16384 channels and a detection count per spectrum channel, said detection count corresponding to the number of detected gamma rays;

calibrating an energy scale of said spectrum;

performing a peak-by-peak analysis of the corresponding gamma-ray energies of chemical elements of interest on said spectrum; and

identifying said chemical substance based on said peak-by-peak analysis of said spectrum.

10. (Twice Amended) A system for identifying a chemical substance, said system comprising:

a neutron source for delivering neutrons into said chemical substance;

a multichannel analyzer operatively associated with a high purity germanium gamma-ray detector;

a computer operatively associated with said multichannel analyzer; and

a computer-readable medium operatively associated with said computer, said computer-readable medium containing instructions for controlling said computer to identify said chemical substance by:

storing first data representative of gamma-ray peak energies corresponding to at least one pre-selected chemical element;

sorting said first data in a pre-selected order having a first peak energy and a last peak energy;

receiving second data representative of gamma-ray counts, wherein said gamma rays are generated by said chemical substance as a result of exposure to said neutrons, and said second data having peaks associated therewith;

searching said second data in a pre-selected order having a first peak and a last peak;

comparing said energies from said first data to said peaks from said second data by comparing said peak energies from said first data to said peaks and peak centroids from said second data;

calibrating an energy scale of said gamma-ray spectrum from said centroid positions and said first data;

extracting net areas and energies of said peaks;

calculating intensities of said peaks from said extracted net areas and counting times;

identifying chemical elements and their ratios contained in said chemical substance from said energies and intensities of said gamma-ray peaks and said second data;

identifying said chemical substance by determining a presence, if any, of a first element selected from the group of phosphorous and chlorine, and a presence, if any, of second elements is selected from the group consisting of arsenic, boron, hydrogen, nitrogen, oxygen, phosphorous, sulfur, silicon, titanium and zinc.

16. The method of claim 1 wherein said calibrating an energy scale is from energies of neutron-induced gamma rays generated from said detector, shielding materials or container materials, independent of fill material, if any, within said container.

17. Cancelled

18. (Once Amended) The method of claim 1 further comprising displaying chemical

elements comprising said identified chemical substance.

19. The method of claim 1 further comprising displaying the identified chemical substance.

20. (Once Amended) The method of claim 18 further comprising displaying a confidence level associated with the identified chemical elements.

21. The method of claim 1 further comprising displaying a confidence level associated with the identified chemical substance.

22. (Once Amended) The method of claim 1 wherein the step of identifying the chemical substance comprises determining a presence, if any, of a first chemical element selected from the group of phosphorous and chlorine, and a ratio of second elements selected from the group consisting of arsenic, boron, hydrogen, nitrogen, oxygen, phosphorous, sulfur, silicon, titanium and zinc.

23. The method of claim 1 further comprising a step of calibrating an electronic gain of said high-resolution detector to adjust a known gamma-ray peak to a pre-selected channel of said high-resolution detector.

24. The method of claim 23 wherein said known gamma-ray peak is associated with hydrogen.

25. The method of claim 24 wherein said known gamma-ray peak associated with hydrogen is generated from neutron interactions within a hydrogenous moderator block.

26. The method of claim 25 wherein the moderator block comprises polyethylene.

27. The method of claim 17 wherein said at least one known chemical element, and gamma-ray energies peaks associated therewith, is selected from the group consisting of germanium, bismuth, aluminum, and iron.

28. (Once Amended) A method for identifying a chemical substance, the method comprising:

inducing neutrons from an isotopic neutron source into a chemical substance, said neutrons interacting within the chemical substance to generate characteristic gamma-rays;

measuring, with a high purity germanium detector, energies of said gamma-rays to create a single gamma-ray energy spectrum;

selecting a data file containing spectral information of at least one known chemical element and gamma-ray peaks associated therewith, said data file being used to calibrate said measured gamma-ray energy spectrum;

performing a directed peak fit analysis comprising determining peak centroids and net peak areas extracted from said calibrated, measured spectrum to determine gamma-ray counting rates for chemical elements of interest;

identifying chemical elements and their ratios contained in said chemical substance;

identifying said chemical substance by determining a presence, if any, of a first element and at least one second element.

29. The method of claim 28 wherein said first element concentration is selected from the group consisting of phosphorous and chlorine.

30. The method of claim 28 wherein said at least one second element concentration is selected from the group consisting of arsenic, boron, hydrogen, nitrogen, oxygen, phosphorous, sulfur, silicon, titanium and zinc.

31. The method of claim 28 further comprising the step of calibrating an electronic gain of said high-resolution detector to adjust a known gamma-ray peak to a pre-selected channel of said high-resolution detector.

32. The method of claim 31 wherein said known gamma-ray peak is associated with hydrogen.

33. The method of claim 32 wherein said known gamma-ray peak associated with hydrogen is generated from neutron interactions within a hydrogenous moderator block.

34. The method of claim 33 wherein the moderator block comprises polyethylene.

35. The method of claim 28 wherein said data file information of at least one known chemical element and gamma-ray peaks associated therewith is selected from the group consisting of iron and chlorine.

36. The method of claim 28 wherein said data information of known chemical elements and gamma-ray peaks associated therewith is comprised of elements contained within said detector, shielding materials or container materials.

37. The method of claim 36 wherein said known chemical elements is selected from the group consisting of germanium, bismuth, aluminum, and iron.

38. The method of claim 28 further comprising displaying the identified chemical elements.

39. The method of claim 28 further comprising displaying the identified chemical substance.

40. The method of claim 28 further comprising displaying a confidence level associated with the identified chemical elements.

41. The method of claim 28 further comprising displaying a confidence level associated with the identified chemical substance.